

Obstetrics: The Science and The Art, by Charles
D. Meigs, M.D.

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Obstetrics: The Science and the Art - Part I. Anatomy of the Parts Concerned In Reproduction; Chapter II. Mechanical Influence of the Pelvis

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CHAPTER II.

MECHANICAL INFLUENCE OF THE PELVIS.—OF THE MECHANISM OF LABOR AS DEPENDENT ON THE RELATIONS OF THE CHILD'S FORM TO THAT OF THE PELVIS.

VERY little seems to have been anciently known concerning what is now called the mechanism of labor as observable while the head or other parts of the child are passing along the canal of the pelvis. No one can doubt that Mauriceau and Lamotte, who were keen observers, must have often noticed the spiral movements of the advancing head or breech in cases of labor, for it is impossible that such circumstances should have wholly escaped their notice, or that of many other highly talented practitioners of our art. Nevertheless, it is very certain that they have nowhere given any clear account of the act of rotation, and I believe that it is now almost universally agreed that we are under obligations, for the first statement concerning it, to Sir Fielding Ould, of Dublin. That gentleman, in 1748, published "*A Treatise of Midwifery, in three parts*, by Fielding Ould, Man-Midwife." Lond. 8vo. pp. 203. Ould gives an account of the matter in his Preface, p. xvi., saying: "And to this end, I hope that the description of the head coming towards the world, with the chin turned to the shoulder, will be of very great advantage;" and he tells us of a case that occurred to him while he was in Paris, in which he seems to have obtained some obscure notions concerning rotation. His promulgation of the doctrine of rotation may be found, such as it is, at page 28: "When a child presents itself naturally, it comes with the head foremost, and (according to all authors that I have seen) with its face towards the sacrum of its mother, so that, when she lies on her back, it seems to creep into the world on its hands and feet. But here I must differ from this description in one point, which, at first sight, may probably seem trivial: the breast of the child does certainly lie on the sacrum of the mother, but the face does not; for it always (when naturally presented) is turned either to one side or the other, so as to have the chin directly on one of the shoulders."

In the next paragraph, which is on p. 29, Sir F. Ould explains his notions of the causes of the head's obliquity, and though he had no very exact perceptions of the facts, it is doubtless to him we should look as the pioneer in this particular section of our obstetrical labors.

Since the date of Sir Fielding Ould's publication, the views of the profession upon the mechanism of labor, in so far as the volume and form of the pelvic canal and those of the foetal head are concerned, have become quite settled, and it is not difficult to set it in such a light as to make it easy of comprehension for the Student. To this end, I ought to say that the gravid womb at full term is about twelve inches in length from the os to the fundus, and from seven to eight inches across at the place of its greatest breadth. A child in utero generally presents its head to the orifice, and as its whole length is from eighteen to twenty inches, it cannot possibly lie stretched out at full length in a space of only twelve inches long. Hence the foetus is doubled up or flexed in all its limbs as well as its trunk, so that it may be said to rest within the womb in a state of universal flexion. The whole trunk is bent forwards; the neck is so bent forwards as to cause the chin to rest upon or near to the breast which serves to point the apex of the head or vertex to the opening; the arms, forearms, and hands are flexed, as are also the thighs and legs. Doubled up in this way the mass of the foetus is olive-shaped, the cephalic pole being downwards, and the pelvic pole upwards. The drawing (Fig. 16), to which I here refer, exhibits very correctly this flexed state of the child in a vertex presentation.

A vertex presentation is one in which the head-pole presents flexed. If the head-pole should present not flexed it would not be a vertex presentation, but it might be a presentation of the crown of the head, of the forehead, or of the face, and whether one or the other of these three, would depend on the degree of departure of the chin from the breast. The chin in a vertex presentation must be at the breast, because the head is flexed, or bent forward. When the head is not flexed, but on the contrary is extended, it is the crown that presents, or the forehead, or lastly, the face.

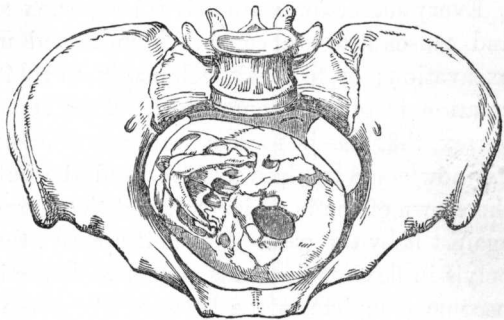
A great majority of children in labor present by the vertex, and the most of them direct the vertex to the left side, while the forehead is to the right side of the pelvis; but in these cases the occipito-frontal diameter crosses the pelvis obliquely from the right sacro-iliac synchondrosis to the left acetabulum.

The superior strait is four, four and a half, and five inches in its antero-posterior, its transverse and oblique diameters. The child's head is 3.88, 4.10, and 5.5 in its biparietal, occipito-frontal and occi-

pito-mental diameters. The spinal column juts forwards like a half column or pilaster so as to overhang the superior strait like a promontory at the sacro-vertebral angle as well as far above it. Hence it is that the biparietal diameter of the child adapts itself to the short diameter of the superior strait, while the occipito-frontal diameter coincides with one of the longer ones, and so it happens that the head comes into the strait obliquely, or as above said with its vertex to the left acetabulum, and its forehead to the right sacro-iliac junction, thus crossing the strait diagonally.

I say diagonally, for, although it be true that a child may descend through the plane in a direct position, *i. e.* with its vertex, or its forehead to the pubis, such direct positions are rarely to be met with; and clinical experience shows that, in the immense majority, the head sinks below the plane with the occipito-frontal diameter coincident with the oblique diameter of the upper strait, as in Figure 20.

Fig. 20.



The foetal head usually descends through the plane of the abdominal strait in flexion, *i. e.* with the chin to the breast, the vertex being turned towards the left

acetabulum, while the bregma, or upper part of the forehead, points towards the right sacro-iliac symphysis: *vid.* Fig. 20. The occipito-frontal diameter is probably nearly coincident with the plane of the strait in the beginning of most labors, whence it appears that the occipito-mental diameter must dip its occipital extremity beneath the plane.

In proportion as the presenting part descends lower and lower, the dip of the occipital pole of the occipito-mental diameter increases. It must be so, since the occipito-frontal diameter could not descend horizontally into a pelvis too narrow for it. That diameter which, by my averages, is 4.10, could not, without a dip or see-saw, sink into the lower part of a pelvis whose transverse diameter, low down in the excavation, does not considerably exceed four inches.

The deeper the head plunges into the cavity, the more strongly is the chin forced against the breast, or, in equivalent terms, the greater the flexion of the head.

Now, let the Student reflect, that the two sides of the pelvis, I mean the planes of the ischia, are inclined towards each other in such a manner that the lower limits of them are half an inch nearer to each other than their upper margins, for the lower strait is only four, whilst the upper one is four and a half inches wide. If the Student will make this reflection, he cannot fail to perceive that this head, placed obliquely or crosswise at the top of the pelvis, must turn on an axis or spin round so as to adapt its short diameter to the shortest diameter of the canal, and its longest one to the longest. In other words, the head must turn or spin round, or, as it is said, rotate within the pelvis. This rotation is caused by the resistance the vertex meets with when forced by the labor-pain against the left ischial plane, which is so inclined that the vertex, which cannot bore its way into or through it must glance off from it, and so move in a forward direction or towards the pubal arch.

Every succeeding pain drives the vertex lower, increases the flexion, and causes it to glance or slide more and more to the forepart of the excavation; or, to speak technically, to rotate more and more until its rotation is fully accomplished. This act of rotation, in which the vertex, that was in the beginning to the left, or near the acetabulum, has now come to place itself behind the pubis, is not completed until the crown of the head has reached the floor of the pelvis, and is forced against it by the pain. Hence it appears that a child's head enters the pelvis in flexion, descends flexed and rotating until the rotation has become complete at the bottom, where the flexion begins to lessen, because the pain pushes the floor of the pelvis down by thrusting the head upon it, which slides along that yielding floor, and emerges under the crown of the pubal arch. The resistance of the floor of the pelvis (*perineum*) is so great that the occipital bone of the head is forced by it upwards between the rami of the pubis, and kept close to the arch. Meanwhile the floor (*perineum*) being thrust further and further down, the head continues to glide upon it and turn over backwards, losing more and more of its flexion, and acquiring more and more its extension, until at last, having become wholly extended, it escapes from the organs and is born, passing outwards with the sagittal suture lying along the middle of the floor, and the middle of the occipital bone resting exactly beneath the lower end of the symphysis pubis.

If the whole *perineum* could be cut away with a bistoury, I could suppose the child's head might come forth from the lower strait without any extension, and with the chin still at the breast; but the pains really thrust the sagittal suture in its whole length, indeed the entire crown of the head, against the elastic resisting *perineum* and posterior

vaginal wall. The efforts, being often repeated, serve to push the perineum away from the crown of the pubal arch to let the vertex escape under it; but, while the perineum is pushed off by this force, the same perineum jams the occipital bone of the child firmly against the crown of the arch; so that, as the vertex emerges from the genital orifice, the os occipitis is pressed close to the symphysis, first at its lower edge, and next on its outer or front aspect. The cranium of the child is born as soon as the extension is complete, but not until then.

Figure 21 exhibits the manner in which the vertex touches the inner surface of the crown of the arch when the rotation is complete. The faint lines show how it rolls out under the edge of the triangular ligament, and also how it next rises upwards in front of the outer surface of the symphysis, the head turning over backwards as it emerges.

Fig. 21.



Restitution.—As soon as the head is born, it begins to rotate back again, outside of the pelvis, to the same point or direction it had upon first engaging within the pelvis. Its originally oblique position becomes restored, and this, which is the last act of mechanism, as to the head, is called the restitution.

Mechanism of the Shoulders' Delivery.—The cause of restitution is to be sought for in the state or position of the shoulders.

When the vertex is at the left acetabulum, the right shoulder is at the right acetabulum, and the left one at the left sacro-iliac synchondrosis: but the inclined plane of the right ischium repels the descending right shoulder, pushing or sliding it downwards, forwards, and to the left, until it comes to the symphysis pubis. The left shoulder meanwhile falls into the open chasm of the hollow of the sacrum that yawns to receive it freely.

This rotation of the shoulders, or, in other words, rotation of the trunk of the body, causes the act of restitution of the head, which, being already born, must turn coincidentally with the rotation of the shoulders.

Such is the act, or rather such is the succession of acts, commonly called the mechanism of the head, in a labor in which the vertex presents in the first position. I shall now recapitulate them as predicated of a vertex presentation in the first position.

1. FLEXION.—The head becomes flexed; the chin going to the breast. It enters the pelvis obliquely, with the vertex to the left acetabulum.

2. ROTATION takes place as it descends, because of the repelling resistance of the plane of the left ischium, the lessened resistance under the arch, and the incurvation or hollow of the sacrum.

3. EXTENSION commences under the upward pressure of the perineum, and continues to increase until the child is born.

4. RESTITUTION allows the vertex to seek its original oblique direction, as it goes back again towards the left acetabulum.

In treating of labors, and the conduct of them, I shall have numerous occasions to refer to, and further explain, the mechanism of the delivery of the foetal head.

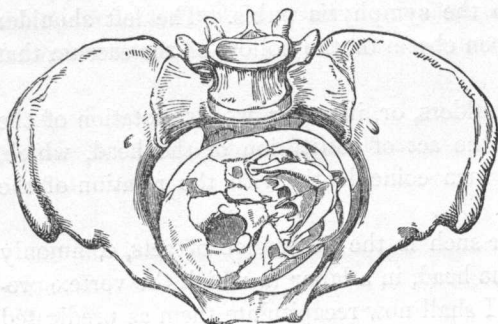
Mechanism of Labor, with Vertex in Second Position.—In this labor the vertex is at the right acetabulum. In saying that the vertex is at the right acetabulum, it is not intended to convey the idea that the posterior fontanelle is always directed absolutely against the acetabular region. Experience will soon teach even a young practitioner, that the child retains in early stages of labor the ability to rotate its head right or left, and that it generally exercises this faculty very freely, spinning its head upon the cervical spine so as to turn the vertex sometimes quite close to the symphysis pubis, and then whirling it back to the top of the ischium, or even as far backwards as the ilio-sacral junction. As the cranium, however, plunges deeper and deeper into the excavation, it becomes so tightly held that these sudden motions cease, and it only moves in the direction impressed upon it by the mechanics of the pelvis.

The processes by which the vertex in a labor of the second position, as in Figure 22, is brought forth, are the converse of those I have

described as taking place in cases of first position. The flexion is followed by the rotation as the head sinks low into the cavity; the vertex being repelled towards the left by the inclined plane of the right ischium.

As soon as the posterior part of the summit of the head reaches the

Fig. 22.



perineum, the perineum, while it yields before the descending power, thrusts the occiput firmly upwards against the crown of the pubal arch, as in the first position. The extension or reversion of the head being completed by its expulsion, restitution then follows by carrying the vertex to the right acetabulum, outside, and the face to the left thigh. The left shoulder turns to the right and forward to get under the arch, while the right shoulder goes back to the sacrum, and so the shoulders are delivered; sometimes, however, the pubal shoulder is the first, and sometimes the sacral one is the first to be expelled.

Third Position.—The mechanism of the head, when the vertex presents in the third position, differs from the two just before described, only in the absence of the second act, the act of rotation.

These third positions are very rarely observed; and it is probable that, when they are met with, they depend upon a peculiar form of the superior strait.

I possess some pelvises in which the antero-posterior diameter of the superior strait greatly exceeds the length of the transverse or oblique diameters. In such a pelvis it is obvious that the vertex would be more likely to present itself at the pubis than at either acetabulum. In an ordinary conformation of the superior strait, a third position of the vertex presentation is extremely unlikely to occur, since, long before the commencement of the labor, the prominence of the lumbar vertebræ, and the overhanging promontory of the sacrum, would be almost sure to turn off the rounded forehead of the child into the right or left sacro-iliac region; and this the more probably, inasmuch as the oblique being greater than the antero-posterior diameter, it affords an easy and inviting accommodation to the usual oblique mode of engagement. The three positions that have here been spoken of comprise the occipito-anterior positions of the vertex. They are those I have been accustomed to enumerate in the following order, viz: first, second, third; or vertex-left, vertex-right, and vertex-front positions.

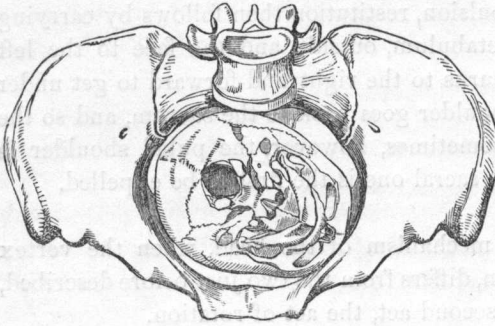
We have next to describe the fourth, fifth, and sixth; or forehead-left, forehead-right, and forehead-front positions of the vertex presentation.

Fourth Position.—In the fourth position, the occipito-frontal diameter crosses the pelvis obliquely, as it does in the first position, with this difference, that its frontal extremity is at the left acetabulum, and its occipital pole at the right sacro-iliac junction. See Fig. 23.

This is a true vertex presentation; and it must not be mistaken for a presentation of the forehead. It is a true vertex presentation, be-

cause the chin is close to the breast, and there is no departure; on the

Fig. 23.



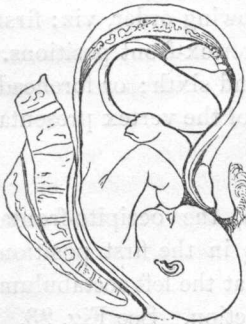
contrary, the flexion is, perhaps, even stronger than in the occipito-anterior positions.

The mechanical form of the pelvis is so miraculously adapted to the wants of the economy in labor, that it has full power, in a major part of these fourth positions, to rotate the vertex from the right sacro-

iliac junction to the right acetabulum and thence to the pubal arch; and that without any assistance given by the accoucheur.

It is true that this favorable rotation does sometimes require the aid of the hand, or even of an instrument, as shall be described on the proper occasion. It also occasionally happens that neither the hand alone, nor any instrument can enable the surgeon to bring the vertex round to the front. In such case, it slides into the hollow of the sacrum, and the labor is thenceforward rendered more painful and more difficult. When, in fourth positions, the vertex can rotate first to the acetabulum and then to the arch, the labor is not seriously retarded, and the mechanism thenceforth is the same as has been already treated of and described; but when the posterior fontanel gets into the hollow of the sacrum, and will not suffer rotation, then the flexion must become greater and greater as the fontanel slides down along the point of the

Fig. 24.



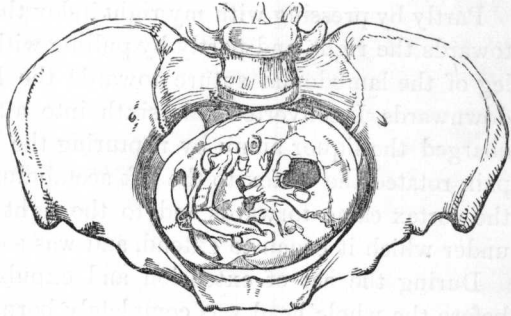
sacrum, over the face of the coccyx, and down the mesial line of the perineum, until, having thrust away the perineum 4.10—the occipito-frontal diameter—the vertex slips over the fourchette, and immediately turns over backwards, in strong extension towards the woman's back. This allows the forehead, eyes, nose, mouth, and chin successively to emerge from underneath the crown of the pubal arch, to complete the birth of the head. The annexed figure (24) of a head in an occipito-posterior position shows these truths clearly enough.

Such is the mechanism in all cases of birth in occipito-posterior

positions, failing rotation to the front; and the Student will clearly understand that it must be so, since the length of the line from forehead to vertex is too great to permit it to be otherwise.

Fifth Position.—The fifth position, as in Fig. 25, is that in which the vertex is to the left ilio-sacral space, and the forehead to the right acetabulum. Here, as in the fourth position, the mechanical form of the pelvis tends to turn the vertex first towards the left acetabulum, and thence to the arch.

Fig. 25.



Sixth Position.—The sixth position finds the vertex at the promontory of the sacrum. Madame Boivin met with only two such positions in 19,614 cases.

I have seen a greater number of sixth positions than were met with by that celebrated midwife, although the labors witnessed by her so greatly exceed in number all that I have seen.

While the facts stated in her tables are to be relied upon for their historic accuracy, her statistical results cannot be admitted as the law of any practitioner's future experience. My own practice, for example, which has been a private practice, has shown me a far greater number of sixth positions than her vast clinical experience, in an immense lying-in hospital, brought to her view. Madame Lachapelle saw no such case.

A case of vertex labor in the sixth position occurred to me this day, of which I made the following note, in order that I might set it down here as a freshly remembered experience.

CASE.—*July 8, 1848, 10½ A. M.* Mrs. E—— I——, Pine street. This is the sixth child; a male, born fifteen minutes ago. The pains commenced moderately, at 4 P. M. yesterday, July 7. Mrs. I. has been in pain at regular intervals all night. I arrived at quarter past nine, one hour since. The os uteri was nearly dilated; membranes unruptured. The anterior fontanel was touched through the membranes just behind the upper half of the symphysis pubis. By a strong pres-

sure, I could conduct the index finger along the sagittal suture directly toward the sacrum, until I felt the triangular fontanel, leaving no doubt of the diagnosis. The left shoulder was at the right, and the right shoulder at the left ischium. The occiput was opposite to the top of the third segment of the sacrum; the flexion of the head was strong.

Partly by pressing with my right index the right temple and zygoma towards the right, and partly by pulling with the same finger the right leg of the lambdoidal suture towards the left side of the pelvis and downwards, I converted this sixth into a fifth position. I now discharged the liquor amnii by rupturing the bag of waters. The next pain rotated the vertex to the left acetabulum or first position, whence the vertex came forwards and to the right until it reached the arch, under which it began to extend, and was soon expelled.

During the act of extension and expulsion of the head, and just before the whole head was completely born, an act of restitution commenced; as soon as the head was free, the vertex went round again left-wards to the sacrum, and the chin of the child rested with its under surface upon the front of the pudenda, the face looking upwards.

This happened because the shoulders had not rotated at all, but plunged into the pelvis, the left one at the right, and the right one at the left ischium.

With the next pain the left shoulder came to the arch, and the right one to the sacrum, and so they were delivered. The child was about seven pounds in weight; in good health.

Here, then, was a clearly marked case of sixth position, notwithstanding which, the mechanical force of the pelvis and its strange adaptation to the form of the cranium, permitted me, with very slight assistance, to convert it into a fifth, and then into a first position. This rotation was fortunate for the mother; since, by effecting it, I prevented the necessity of a dilatation equal to the occipito-frontal circumference nearly, and thus rendered necessary a dilatation equal merely to the bi-parietal circumference; the former being nearly fifteen inches, while the latter is not more than twelve inches.

August 4, 1856. I attended a labor last night, in which the child presented in the sixth position. I touched the ossa nasi behind the top of the pubis, yet the pelvis rotated the head, and the vertex came to the front, and was easily born.

Face Presentation.—When the head presents in extension instead of coming down in flexion, we have presentation of the forehead, or of the face. If the extension be moderate, the forehead presents; if it

be very great, the face presents. When the face presents, it always comes down with the chin to one side, and the top of the forehead to

Fig. 26.

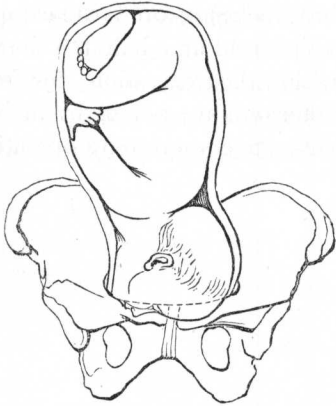


Fig. 27.



the other side of the pelvis; and afterwards rotates the chin to the pubis or to the sacrum. In the case (Fig. 26), the chin is to the right ischium and the forehead to the left ischium. The natural movement of the mechanism would gradually turn this chin to the front of the pelvis, and the top of the forehead to the sacrum, as in Fig. 27.

In face presentations, the chin must be born first; see Fig. 27. Here observe, that from the chin to the vertex is more than five inches, while there is no diameter five inches long to be found within the true pelvis. Hence, if the mental extremity of the occipito-mental diameter descends into the cavity before the occipital extremity, it must escape first from the outlet in order to allow the occipital extremity to escape last, and *vice versâ*.

There are many cases of face presentations that appear to afford remarkably easy deliveries, and to require no aid from the hand. In all those, however, where assistance is demanded, there is an important doctrine, one that should never be lost sight of in the conduct of the cases. The doctrine is this—Bring the chin to the pubis. The figure may show that, if the chin be brought to the pubis, it will have to sink only an inch, or an inch and a quarter lower than the brim, in order to get below the level of the crown of the arch: as soon as it reaches that point, it comes out beneath the arch, and thus the mental extremity of the occipito-mental diameter begins to be born. When this first step is effected, the whole length of that diameter is soon expelled, or, in other words, the whole head is born; its occipital extremity being the last portion to emerge from the ostium vaginae.

Should any one, in practice, forgetting this doctrine, bring the forehead to the pubis, he would do a great wrong; for, as the chin must be born first, and the occiput last, the chin will have to slide along the whole length of the sacrum five inches; and over the extended perineum two and a half or three inches before it can escape; but, to do this, it will be required that the head and half the thorax of the child shall be together jammed within the excavation; for from the chin of the child to the top of its sternum are not eight inches. Such a position is almost sure to demand an embryotomy operation for the delivery of the fetus.

out of the pelvis and afterwards...
 the chin to the pubis...
 the occiput last...
 the sacrum five inches...
 the perineum two and a half or three inches...
 the head and half the thorax...
 the excavation...
 the chin of the child to the top of its sternum...
 the embryo...
 the fetus...
 the delivery...
 the operation...
 the embryo...
 the fetus...
 the delivery...
 the operation...